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Math as a Second Language

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Math as a Second Language

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a STEM Initiative
Observing in Schools: A Guide for Students in Teacher Education
E. F. Provenzo, Jr. & W. E. Blanton  2006
According to Giroux:
….border pedagogy offers the opportunity for students to engage the multiple references that constitute different cultural codes, experiences and languages. This means educating students to both read these codes historically and critically while simultaneously learning the limits of such codes, including the ones they use to construct their own narratives and histories.”
Language of Mathematics

Steps in the Overall Process of Applying Mathematics to a Problem

1. Actual Problem
2. English Text
3. Mathematical Model
4. Mathematical Solution
5. English Text
6. Implemented Solution
Some Observed Issues

*Students with high skills but low standardized performance

*Standardized exams contain progressively more application problems

*In class students fail to have transference of math skills into application problems

*Poor language choices destroy a student’s ability to understand
Old McDonald had a farm, E-I-E-I-O! And on that farm he had some chickens, E-I-E-I-O! With a chick, chick here, and a chick, chick there, here a chick, there a chick, everywhere a chick, chick! Old McDonald had a farm, E-I-E-I-O! And on that farm he had some cows, E-I-E-I-O! With a moo, moo here, and a moo, moo there, here a moo, there a moo, everywhere a moo, moo! Old McDonald had a farm, E-I-E-I-O!
Old McDonald has a farm with cows and chickens. He counted a total of 36 heads and a total of 104 feet. How many cows and chickens does Old McDonald have on his farm?

• Determine the equations needed for Old McDonald to solve this problem
• Determine the solution by one of the three methods you have learned to solve a system of linear equations
• Show the solution graphically (if not already done)
• Did all three methods give you the same solution? Why or why not?
Solution to the first problem

- Old McDonald has a farm with cows and chickens. He counted a total of 36 heads and a total of 104 feet. How many cows and chickens does Old McDonald have on his farm?
- Equations: cow heads + chicken heads = 36 total heads
  4cow feet + 2chicken feet = 104 total feet
- Solution using Elimination
  cow + chicken = 36
  -4cow - 4chicken = -144
  -2chicken = -40
  Thus: chickens = 20.
  cow + chickens = 36
  cow + 20 = 36
  cow = 16
- Graphically
  They all gave the same solution, because that is the only solution for how many cows and chickens he could have based on the total number of heads and feet he counted.
Analyzing the Lesson

Based on Baber’s steps dealing with the language of math, is there anything missing in this lesson?
Old McDonald has a farm with cows and chickens. He counted a total of 36 heads and a total of 104 feet. How many cows and chickens does Old McDonald have on his farm?

What is important?
- Cows and chickens
- 36 heads and 104 feet

Why is it important?
- Cows have more feet than chickens
- Cows and chickens have only one head.
English Text

What is important?
✓ Cows and chickens
✓ 36 heads and 104 feet

Why is it important?
Cows have more feet than chickens.
Cows and chickens have only one head.

Math Model

Find the equations and set up a method of finding the solution

cows + chickens = 36

4 cows + 2 chickens = 104
Let cows = x & let chickens = y

\[ x + y = 36 \]
\[ 4x + 2y = 104 \]

\[ -4x - 4y = -144 \]
\[ 4x + 2y = 104 \]

\[ -2y = -40 \]
\[ y = 20 \]

\[ x + y = 36 \]
\[ x + 20 = 36 \]

\[ x = 16 \]

Old McDonald has 16 cows and 20 chickens. This solution is found algebraically by multiplying the equation for total heads by -4. This allows the cows, (x’s) to be eliminated by adding the equations together. Now we see that -2y = -40, so by use of the multiplicative inverse we arrive at y = 20. We previously said y was chickens, so there are 20 chickens. To find the number of cows, we simply substitute the number of chickens into the equation for total heads. By using the additive inverse we isolate the number of cows. X = 16, which means there are 16 cows.
Sample Stat Problem

Data on the number of hours of study per week for twenty-four college students in the stats class was reported in table form.

Using the five number summary construct a response analyzing the variation within the data.

• 8 9 9 12 14 15 17 17 18 18 18 19 21 22 22 24 27 27 29 30 31 32 35 40

• What does the Five-Number Summary say about the degree of variation in these data?
Five Number Summaries

Min = 8
Q1 = 16
M = 20
Q3 = 28
Max = 40

2.) Draw a graph for illustrating the variation in the data based on the Five-Number Summary
What is the total variation?

- What is the variation of the middle 50%?
  - How do these two variations compare?
    - What is the upper 50% variation versus lower 50% variation?
  - What are the oddities indicated by the data (if present)?

We can obtain the total variation by subtracting our minimum value by our maximum value which will give us our total variation to be 32.
Middle 50% Variation

- Where is the location of the middle half of our data?
- It is bounded by quartile one and quartile three
- Our Middle 50% has a variation of 12.
- Comparison: This amount of variation accounts for less than half of the total variation

Oddities

- Extreme differences in quartiles and existence of outliers
  - We can determine our outliers by obtaining our inner quartile range
  - Inner quartile range = Q3 - Q1
  - Upper outlier = Q3 + 1.5(IQR) = 28 + 1.5(12) = 46
  - Lower outlier = Q1 - 1.5(IQR) = 16 - 1.5(12) = -2
  - When calculating our outliers we can see that there are no outliers.
What does the Five-Number Summary say about the degree of variation in these data?

By the Five-Number Summary we can see that the number of weekly hours of study for the college stats class had a total variation of 32 hours. The median number of study hours per week is 20. The middle 50% of the data has a variation of 12 hours per week, which is less than half of the total variation. This indicates that the middle half of the data values take up less than half of the total spread. The upper 50% of the data has a variation of 20 hours of study, whereas the lower 50% of the data only has a variation of 12 hours per week. This may indicate that the 50% of students reporting the most study time have much more variation between one another. There are no outliers in our survey of weekly study times, since the lower limit is -2 and the upper limit is 42. It is notable that Q4, which accounts for 25% of the data values alone, has the same amount of variation as the middle 50%. This indicates that there may be a reported number of study hours that is well beyond the rest of the group, but does not qualify as an outlier.
More Stats
References
